NASA SBIR/STTR Technologies

S1.01-9021 - High-power tunable seed laser for methane LIDAR transmitter

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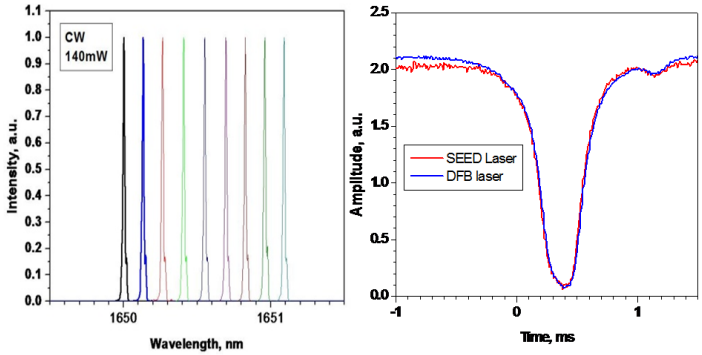
Identification and Significance of Innovation

We propose to develop a robust fiber-coupled tunable seed laser with an output power of >500 mW at 1651 nm. We will leverage initial work carried out at Princeton Lightwave Inc. in the development of injection locking technology, and we will investigate a variety of factors which impact injection locking stability and spectral range. This technical approach leverages our excellent legacy capability in the design and manufacturing of commercial single-mode InGaAs/InP ridge waveguide (RWG) laser diodes and will allow us to dramatically improve the high-power performance of 1651 nm diode lasers.



LEFT: Coarse spectral position tuning of high power seed laser. RIGHT: measured methane absorption line, showing equivalence using low power DFB laser (blue light) and 170 mW high power seed laser with injection locking technology (red line).

Estimated TRL at beginning and end of contract: (Begin: 3 End: 5)

Technical Objectives and Work Plan

TECHNICAL OBJECTIVES I. Develop an injection locking theory for an all-semiconductor master-oscillator power-amplifier (MOPA) device entailing a low-power DFB laser diode and a high power Fabry-Perot RWG laser diode. II. Analyze and select potential epi-designs for single-mode high-power RWG laser diodes capable of a dramatic increase in output power relative to state-of-the-art designs. III. Investigate potential RWG designs for increased single-mode fiber coupling efficiency and increased power in the fundamental RWG optical mode. IV. Experimentally prove the key elements of prospective epi-wafer and RWG designs.
WORK PLAN 1.A. Develop an injection locking theory for low power DFB laser diodes as master oscillator and high power FP RWG laser diode as slave laser 1.B. Experimental proof of calculation results 2.A. Analyze prospective epi-designs developed for high-power multi-mode broad-area laser diodes 2.B. Designing and modeling epi-structure incorporating new design solutions 3.A. Develop a theoretical model for complex RWG geometries 3.B Select prospective RWG design based on the model developed in Task 3.A 4. Experimentally prove elements of prospective designs

NASA Applications

--LIDAR instruments intended for the measurement of methane in the Earth's atmosphere --Active remote sensing optical instruments (LIDAR)

Non-NASA Applications

--Remote gas sensing --Range-finding and ladar applications --Commercial wind lidar systems --Telecom systems --Medical systems

Firm Contacts

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